

## 2023 NYSDEC Lake Reports – Data Sources and Analyses

Lake reports are a document that display data collected by NYSDEC’s Lake Classification and Inventory (LCI) program and the Citizen Statewide Lake Assessment Program (CSLAP). Data collected from these programs help us understand a waterbody’s overall condition. However, additional, external data sources are needed to contextualize the results. The purpose of this document is to give a detailed description of data sources and analyses used to generate the lake reports. The lake reports include a header and six sections. The data sources and analyses for each are given below.

### I. Header

The watershed map in the header of the lake report was created in R using the tmap package (R Core Team, 2023; Tennekes, 2018). Esri’s “World Topographic Map” was used as a basemap for the larger, zoomed in map displaying the watershed delineation for the report’s waterbody (Esri, 2017). Almost all other watershed delineations were obtained from the LakeCat dataset (Hill et al., 2018). If the watershed is less than 40 acres, the watershed delineation is pulled from USGS’s StreamStats program (U.S. Geological Survey, 2019b). Delineations for most lakes on Long Island or Staten Island are hand drawn using elevation contours from NYS GIS Resources and USGS’s stream grid since StreamStats does not support batch processing in these areas (NYS, 2023; USGS, 2015). The unique delineation for each waterbody was laid over the basemap to create this piece of the map. In the bottom right-hand corner is a smaller map showing the location of the waterbody within NYS. Using the maps package in R, a layer of states was filtered to NY and utilized for the outline (Becker et al., 2022).

The Lake Characteristics table was made up of data from different sources. Lake Classification and Public Water Supply were drawn from the NYSDEC Monitoring and Assessment Database. Dam Classification was extracted from the feature layer “Dams” located on the NYS GIS Clearinghouse. Dams

classified as A are low hazard dams; B are intermediate hazard dams; C are high hazard dams; hazard classifications are not assigned if 0; and NA means there is no dam data for the waterbody (NYSDEC Publisher, 2009). Lake Size was also obtained from NHD and WI/PWL layers in GIS by calculating geometry of the polygons (USGS, 2019a; NYSDEC Publisher, 2021). Mean Depth was taken from the product of “Predicting Maximum Lake Depth from Surrounding Topography” (Hollister, 2011). Where CSLAP or LCI maximum sounding depth measurements were available after 2020, they were used instead of the predicted value.

Watershed area was calculated in GIS by calculating geometry of the watershed delineation polygons. The Watershed to Lake Ratio was calculated by taking the Watershed Area and dividing it by the Lake Size. If one of these values is missing, the ratio is set to equal “NA.” Land Use Percentages were obtained from the National Land Cover Database (NLCD). The 2021 NLCD layer was read into GIS with the previously created watershed delineations. Within the watershed polygons, the sum of raster cells for each land use classification were calculated. This data was exported as a table and the values were computed into percentages. Values of the Open Water classification were omitted in percentage calculations. Percentages of land use classifications were then split into 7 categories for the Watershed Characteristics table (Dewitz, 2023). The Wetlands value was calculated by adding the Emergent Herbaceous Wetlands field to the Woody Wetlands field. The Barren Land, Shrub Scrub, and Grassland Herbaceous values are made up of only the fields with those names. Deciduous Forest, Evergreen Forest, and Mixed Forest were combined to calculate the Forest value. Developed Open Space, Developed Low Intensity, Medium Intensity, and High Intensity were added together to calculate the Developed value. The Agriculture value was calculated by adding the Cultivated Crops and Pasture Hay fields together. Each value is truncated to remove decimals in the final product. If there is no data for a waterbody, all values will equal “NA.”

The lower table in the header holds the Waterbody Assessment, Trophic State, HABs Frequency, and Invasive Species. The Waterbody Assessment links to the NYSDEC webpage that holds the most

updated waterbody segment factsheet for the waterbody that is being viewed (NYSDEC, 2021). Trophic State calculations were derived from “SOP #203 Collection of Lake Water Quality Samples” (NYSDEC, 2022). Data from New York Harmful Algal Bloom System (NYHABS) was utilized to calculate HABS frequency. It was filtered to those records that were either “Confirmed” or “Confirmed with High Toxins.” “Periodic Blooms” refers to those lakes that have 1-3 reports in the entire data record. Any more than 3 confirmed reports since 2012 and the table reads “Frequent Blooms.” If there are no records for the waterbody, the table reads “No Reported Blooms.” iMapInvasives data was used for the Invasives Species section (iMapInvasives, 2023). If there are no records, the table reads “No Invasives Reported” and if there are any records it reads “Invasives Reported.”

## II. NYSDEC Data Processing

Data utilized for plots within the Evaluated Data, Trophic State, Depth Profile, and Other Parameters tabs is the result of NYSDEC’s Lake Classification and Inventory Program (LCI) and Citizen Statewide Lake Assessment Program (CSLAP). Rejected data is not included in the Lake Reports. Non-detects are reported as half the detection limit.

## III. Data Plots

All plots in the Lake Report were created in R with the ggplot2 package and joined together with the gridExtra package (Auguie, 2018; R Core Team, 2023; Wickham, 2016). Data points in the seasonal plot utilize the geom\_jitter function, which varies the location of each point slightly to avoid overlap. The statewide distribution plots are probability distribution functions generated by the 2020-2021 NYSDEC random probabilistic study (Onion and Kraft, unpublished manuscript). The horizontal line on the statewide distribution plot displays the median value for the lake being viewed which is also reported in the text box to the right of each plot. The trend statements for each parameter were created using Kendall Tau Seasonal Trend analysis per methods in Onion et al. (unpublished manuscript). An asterisk (\*) is used to indicate statements are confirmed with this statistical test.

## IV. Evaluated Data:

Sampling data were compared to NYS Water Quality Standards (WQS) and Guidance Values (GVs) according to the NYSDEC Consolidated Assessment and Listing Methodology (NYSDEC, 2023; NYDOS, 2021). Excursions of the WQS or GV's are highlighted red in the data plots.

## V. Trophic State

Trophic state values were calculated according to SOP #203 Collection of Lake Water Quality Samples” which is based on the standard Carlson assessment criteria and tailored to NY (NYSDEC, 2012; NYSDEC, 2022).

## VI. HABs

New York Harmful Algal Bloom System (NYHABS) data was filtered to reports that were “confirmed”, “confirmed with high toxins”, or “suspicious” (NYSDEC, 2018; NYSDEC 2020). The plot shows the occurrence of reported and confirmed bloom reports across the season annually. The color of each point indicates the broadest geographic extent as defined in the HABs program guide (NYSDEC,2022) which was reported from that date and location. If there is no plot displayed within this tab, there have been no reports to NYHABS on the waterbody.

## VII. Invasive Species

The Invasive Species tab was derived from iMapInvasives data (iMapInvasives, 2023). The results were filtered to remove records with “NA” as the “Common Name”. If there is no table displayed within this tab, there have been no invasive species reported to iMapInvasives.

## VIII. Depth Profile

Data collected from Depth Profile measurements were reduced to one measurement per depth value. A plot is generated for each of the 8 parameters if data was collected. If a parameter is not collected, the space where the plot typically resides will display a text box saying so. If Depth Profile measurements were not collected, this tab reads “Depth Profiles were not collected from *lake name*.” This is not a standard part of CSLAP data collection, so this section will be left blank for many CSLAP lakes.

## IX. Other Parameters

Additional parameters are reported in Other Parameters to understand properties of the waterbody that aren't related to the topics above. The focus and purpose of each parameter is described to the right of the plots.

## X. Data

The Data tab provides all the Sample Locations, Results, and HAB data available for this waterbody. Data may be downloaded for external use. All the locations sampled are given in the Sample Locations tab and provide location specific information for each location given in the Results and HAB data tables (NYSDEC, 2018; NYSDEC 2020).

## XI. References and Citations

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